

# STORMWATER SITE PLANNING

## 1.5.1 Stormwater Management and Site Planning

### 1.5.1.1 Introduction

In order to most effectively address stormwater management objectives, consideration of stormwater runoff needs to be fully integrated into the site planning and design process. This involves a more comprehensive approach to site planning and a thorough understanding of the physical characteristics and resources of the site. The purpose of this section is to provide a framework for including effective and environmentally sensitive stormwater management into the site development process and to encourage a greater uniformity in stormwater management site plan preparation.

When designing the stormwater management system for a site, a number of questions need to be answered by the site planners and design engineers, including:

- How can the stormwater management system be designed to most effectively meet the stormwater management minimum standards (and any additional needs or objectives)?
- What are the opportunities for utilizing better site design practices to minimize the need for structural stormwater controls?
- What are the development site constraints that preclude the use of certain structural controls?
- What structural controls are most suitable and cost-effective for the site?

### 1.5.1.2 Principles of Stormwater Management Site Planning

The following principles should be kept in mind in preparing a stormwater management plan for a development site:

- 1. The site design should utilize an integrated approach to deal with stormwater quantity, quality and stream bank (channel) protection requirements.**

The stormwater management infrastructure for a site should be designed to integrate drainage and water quantity control, water quality protection, and downstream channel protection. Site design should be done in unison with the design and layout of stormwater infrastructure to attain stormwater management goals. Together, the combination of better site design practices and effective infrastructure layout and design can mitigate the worst stormwater impacts of most urban developments while preserving stream integrity and aesthetic attractiveness.

- 2. Stormwater management practices should strive to utilize the natural drainage system and require as little maintenance as possible.**

Almost all sites contain natural features which can be used to help manage and mitigate runoff from development. Features on a development site might include natural drainage patterns, depressions, permeable soils, wetlands, floodplains, and undisturbed vegetated areas that can be used to reduce runoff, provide infiltration and stormwater filtering of pollutants and sediment, recycle nutrients, and maximize on-site storage of stormwater.

Site design should seek to improve the effectiveness of natural systems rather than to ignore or replace them. Further, natural systems typically require low or no maintenance, and will continue to function many years into the future.

- 
3. **Structural stormwater controls should be implemented only after all site design and nonstructural options have been exhausted.**

Operationally, economically, and aesthetically, stormwater better site design and the use of natural techniques offer significant benefits over structural stormwater controls. Therefore, all opportunities for utilizing these methods should be explored before implementing structural stormwater controls such as wet ponds and sand filters.

4. **Structural stormwater solutions should attempt to be multi-purpose and be aesthetically integrated into a site's design.**

A structural stormwater facility need not be an afterthought or ugly nuisance on a development site. A parking lot, soccer field or city plaza can serve as a temporary storage facility for stormwater. In addition, water features such as ponds and lakes, when correctly designed and integrated into a site, can increase the aesthetic value of a development.

5. **"One size does not fit all" in terms of stormwater management solutions.**

Although the basic problems of stormwater runoff and the need for its management remain the same, each site, project, and watershed presents different challenges and opportunities. For instance, an infill development in a highly urbanized town center will require a much different set of stormwater management solutions than a low-density residential subdivision in a largely undeveloped watershed. Therefore, Columbia County stormwater management needs to take into account differences between development sites, different types of development and land use, various watershed conditions and priorities, the nature of downstream lands and waters, and community desires and preferences.

## **1.5.2 Preparation of Stormwater Management Site Plans**

### **1.5.2.1 Introduction**

A stormwater management site plan is a comprehensive report that contains the technical information and analysis to allow a Columbia County to determine whether a proposed new development or redevelopment project meets the Columbia County's stormwater regulatory requirements and/or the minimum stormwater management standards contained in this Manual.

This section describes the typical contents and general procedure for preparing a stormwater management site plan. The level of detail involved in the plan will depend on the project size and the individual site and development characteristics.

The preparation of a stormwater site plan ideally follows these steps:

- (1) **Pre-consultation Meeting and Joint Site Visit**
- (2) **Review of Columbia County Requirements**
- (3) **Perform Site Analysis**
- (4) **Prepare Stormwater Concept Plan**
- (5) **Prepare Preliminary Stormwater Site Plan**
- (6) **Complete Final Stormwater Site Plan**

### **1.5.2.2 Pre-consultation Meeting and Joint Site Visit**

The most important action that can take place at the beginning of the development project is a pre-consultation meeting between the Columbia County and the developer and his team to outline the stormwater management requirements and other regulations, and to assist the developer in assessing constraints, opportunities, and potential for stormwater design concepts.

This recommended step helps to establish a constructive partnership for the entire development process. A joint site visit, if possible, can yield a conceptual outline of the stormwater management plan and strategies. By walking the site, the two parties can identify and anticipate problems, define general expectations and establish general boundaries of natural feature protection and conservation areas. A major incentive for pre-consultation is that permitting and plan approval requirements will become clear at an early stage, increasing the likelihood that the approval process will proceed faster and more smoothly.

---

### 1.5.2.3 Review of Columbia County Requirements

The site developer should be made familiar with the Columbia County stormwater management and development requirements and design criteria that apply to the site. These requirements may include:

- The minimum standards for stormwater management included in this Manual (see Section 1.2).
- Design storm frequencies
- Conveyance design criteria
- Floodplain criteria
- Buffer/setback criteria
- Wetland provisions
- Watershed-based criteria
- Erosion and sedimentation control requirements
- Maintenance requirements
- Need for physical site evaluations (infiltration tests, geotechnical evaluations, etc.)

Much of this guidance can be obtained at the pre-consultation meeting with Columbia County staff and is detailed in various ordinances (e.g., subdivision codes, stormwater and drainage codes, etc.)

Current land use plans, comprehensive plans, zoning ordinances, road and utility plans, watershed or overlay districts, and public facility plans should all be consulted to determine the need for compliance with other Columbia County and state regulatory requirements.

Opportunities for special types of development (e.g., clustering) or special land use opportunities (e.g., conservation easements or tax incentives) should be investigated. There may also be an ability to partner with Columbia County for the development of greenways, or other riparian corridor or open space developments.

### 1.5.2.4 Perform Site Analysis and Inventory

Using approved field and mapping techniques, the site engineer should collect and review information on the existing site conditions and map the following site features:

- Topography
- Drainage patterns and basins
- Intermittent and perennial streams
- Soils
- Ground cover and vegetation
- Existing development
- Existing stormwater facilities
- Adjacent areas

In addition, the site engineer should identify and map all previously unmapped natural features such as:

- Wetlands
- Critical habitat areas
- Boundaries of wooded areas
- Floodplain boundaries
- Steep slopes
- Required buffers
- Proposed stream crossing locations
- Other required protection areas (e.g., well setbacks)

Some of this information may be available from previously performed studies or from the previous feasibility study. For example, if a development site requires a permit under the Erosion and Sedimentation Act, most of the resource protection features will likely have been mapped as part of the land disturbance activity plan. Other recommended site information to map or obtain includes utilities information, seasonal groundwater levels, and geologic mapping.

Individual map or geographic information system (GIS) layers can be designed to facilitate an analysis of the site through what is known as map overlay, or a composite analysis. Each layer (or group of related information layers) is placed on the map in such a way as to facilitate comparison and contrast with other layers. A composite layer is often developed to show all the layers at the same time (see Figure 1.5.2-1). This composite layer can be a useful tool for defining the best buildable areas and delineating and preserving natural feature conservation areas.

### 1.5.2.5 Prepare Stormwater Concept Plan

The requirement for a Stormwater Concept Plan applies to activities involving five acres or more of total land (not just disturbed area), unless specifically exempted or granted a variance pursuant to Chapter 34 of the Code of Ordinances of Columbia County, Georgia. Based upon the review of existing conditions and site analysis, the design engineer shall develop a concept site layout plan for the project.

During the concept plan stage the site designer will perform most of the layout of the site including the preliminary stormwater management system design and layout. The stormwater concept plan allows the design engineer to propose a potential site layout and gives the developer and Columbia County a “first look” at the stormwater management system for the proposed development. The stormwater concept plan shall be submitted to Columbia County before detailed preliminary site plans are developed.

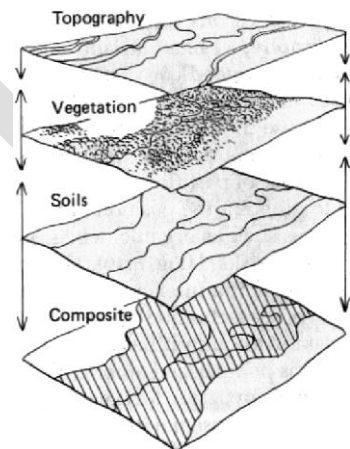
The following steps should be followed in developing the stormwater concept plan:

- (1) Use better site design approaches (see Section 1.4) as applicable to develop the site layout, including:
  - Preserving the natural feature conservation areas defined in the site analysis
  - Fitting the development to the terrain and minimizing land disturbance
  - Reducing impervious surface area through various techniques
  - Preserving and utilizing the natural drainage system wherever possible
- (2) Calculate preliminary estimates of the unified stormwater sizing criteria requirements for water quality, channel protection, overbank flooding protection and extreme flood protection based on the concept plan site layout (Section 1.3)
- (3) Determine the site design stormwater credits to be accounted for in the design of structural stormwater controls handling the water quality volume (Section 1.4)
- (4) Perform screening and preliminary selection of appropriate structural stormwater controls and identification of potential siting locations (Section 3.1).

It is extremely important at this stage that stormwater design is integrated into the overall site design concept in order to best reduce the impacts of the development as well as provide for the most cost-effective and environmentally sensitive approach. Using hydrology calculations, the goal of mimicking pre-development conditions can serve a useful purpose in planning the stormwater management system.

For Columbia County review purposes, the stormwater concept plan should include the following elements:

- (1) Common address and legal description of site
- (2) Vicinity map
- (3) Existing conditions and proposed site layout mapping and plans (recommended scale of 1" = 50'), which illustrate at a minimum:



**Figure 1.5.2-1  
Composite Analysis**  
(Source: Marsh, 1983)

- Existing and proposed topography (minimum of 2-foot contours required)
  - Perennial and intermittent streams
  - Mapping of predominant soils from USDA soil surveys
  - Boundaries of existing predominant vegetation and proposed limits of clearing and grading
  - Location and boundaries of other natural feature protection and conservation areas such as wetlands, lakes, ponds, floodplains, stream buffers and other setbacks (e.g., drinking water well setbacks, septic setbacks, etc.)
  - Location of existing and proposed roads, buildings, parking areas and other impervious surfaces
  - Existing and proposed utilities (e.g., water, sewer, gas, electric) and easements
  - Preliminary estimates of unified stormwater sizing criteria requirements
  - Identification and calculation of stormwater site design credits
  - Preliminary selection and location, size, and limits of disturbance of proposed structural stormwater controls
  - Location of existing and proposed conveyance systems such as grass channels, swales, and storm drains
  - Flow paths (pre and post development conditions)
  - Location of floodplain/floodway limits and relationship of site to upstream and downstream properties and drainages
  - Preliminary location and dimensions of proposed channel modifications, such as bridge or culvert crossings
  - The existing 100-year floodplain
- (4) A general description of adjacent property and a description of existing structures, buildings, and other fixed improvements located on surrounding properties.
- (5) A listing and brief description of erosion, sediment and stormwater control BMPs to minimize pollution during construction.
- (6) A listing and brief narrative of BMPs to minimize pollution after construction has ended.
- (7) Identification of preliminary waiver requests.

### **1.5.2.6 Prepare Preliminary Stormwater Site Plan**

The requirement for a Stormwater Management Plan applies to all land disturbing activities, regardless of size, unless specifically exempted or granted a variance pursuant to Chapter 34 of the Code of Ordinances of Columbia County, Georgia.

The preliminary plan ensures that requirements and criteria are being met and that opportunities are being taken to minimize adverse impacts from the development.

The preliminary stormwater management site plan should consist of maps, narrative, and supporting design calculations (hydrologic and hydraulic) for the proposed stormwater management system, and should include the following sections:

#### **(1) Existing Conditions Hydrologic Analysis**

Existing conditions shall be defined as the conditions of the site at the time a land disturbing permit application is submitted. The existing conditions shall include on-site lakes and ponds. Pre-developed flows shall be determined by routing the pre-developed flows through these water bodies.

Provide an existing condition hydrologic analysis for stormwater runoff rates, volumes, and velocities, which includes:

- A topographic map of existing site conditions (minimum 2-foot contour interval required) with the basin boundaries indicated
- Acreage, soil types and land cover of areas for each sub-basin affected by the project
- All perennial and intermittent streams and other surface water features

- All existing stormwater conveyances and structural control facilities
- Existing runoff volumes from the 2, 5, 25, 50 and 100-year 24-hour storm events
- Adjacent property (This should include the identification of land use and cover conditions.)
- Direction of flow and exits from the site (point of discharge)
- Analysis of runoff provided by off-site areas upstream of the project site
- Methodologies, assumptions, site parameters and supporting design calculations used in analyzing the existing conditions site hydrology
- The existing 100-year floodplain

## **(2) Post-Development Hydrologic Analysis**

Provide a post-development hydrologic analysis for stormwater runoff rates, volumes, and velocities, which includes:

- A topographic map of developed site conditions (minimum 2-foot contour interval required) with the post-development basin boundaries indicated
- Total area of post-development impervious surfaces and other land cover areas for each sub-basin affected by the project
- Unified stormwater sizing criteria runoff calculations for water quality, channel protection, overbank flooding protection and extreme flood protection for each sub-basin
- Post-Development runoff volumes from the 2, 5, 25, 50 and 100-year 24-hour storm events
- Location and boundaries of proposed natural feature protection and conservation areas
- Documentation and calculations for any applicable site design credits that are being utilized
- Methodologies, assumptions, site parameters and supporting design calculations used in analyzing the existing conditions site hydrology

## **(3) Stormwater Management System**

Provide drawings and design calculations for the proposed stormwater management system, including:

- A drawing or sketch of the stormwater management system including the location of non-structural site design features and the placement of existing and proposed structural stormwater controls. This drawing should show design water surface elevations, storage volumes available from zero to maximum head, location of inlet and outlets, location of bypass and discharge systems, and all orifice/restrictor sizes.
- Narrative describing that appropriate and effective structural stormwater controls have been selected.
- Cross-section and profile drawings and design details for each of the structural stormwater controls in the system. This should include supporting calculations to show that the facility is designed according to the applicable design criteria.
- Hydrologic and hydraulic analysis of the stormwater management system for all applicable design storms (should include stage-storage or outlet rating curves, and inflow and outflow hydrographs)
- Documentation and supporting calculations to show that the stormwater management system adequately meets the unified stormwater sizing criteria
- Drawings, design calculations and elevations for all existing and proposed stormwater conveyance elements including stormwater drains, pipes, culverts, catch basins, channels, swales and areas of overland flow

## **(4) Downstream Analysis**

Provide the assumptions and calculations from a downstream analysis (when required)

- Supporting calculations for a downstream peak flow analysis using the ten-percent rule necessary to show safe passage of post-development design flows downstream

---

In calculating runoff volumes and discharge rates, consideration may need to be given to any planned future upstream land use changes. Depending on the site characteristics and given design criteria, upstream lands may need to be modeled as “existing condition” or “projected build-out/future condition” when sizing and designing on-site conveyances and stormwater controls.

### **1.5.2.7 Complete Final Stormwater Site Plan**

The Stormwater Management Plan shall be prepared, certified, and stamped/sealed by a qualified State of Georgia registered Professional Engineer. The final stormwater management site plan adds further detail to the preliminary plan and reflects changes that are requested or required by Columbia County. The final stormwater site plan should include all of the revised elements of the preliminary plan as well as the following items:

#### **(1) Erosion, Sedimentation and Pollution Control Plan**

- Must contain all the elements specified in the Georgia Erosion and Sediment Control Act and Columbia County ordinances and regulations
- Sequence/phasing of construction and temporary stabilization measures
- Temporary structures that will be converted into permanent stormwater controls

#### **(2) Landscaping Plan**

- Arrangement of planted areas, natural areas and other landscaped features on the site plan
- Information necessary to construct the landscaping elements shown on the plan drawings
- Descriptions and standards for the methods, materials and vegetation that are to be used in the construction

#### **(3) Water Quality BMPs**

- Detailed drawings indicating construction and design details can be utilized along with standard engineering drawings of structures and measures so long as site specific elevations, dimensions, and characteristics are shown.
- Support data and calculations should be sufficient to allow reviewers to reproduce design procedure of structures and measures. Sources of information should be cited.

#### **(4) Operations and Maintenance Plan**

- Description of maintenance tasks, responsible parties for maintenance, funding, access and safety issues
- Any stormwater management facility which serves a single lot or commercial or industrial activity shall be privately owned and shall develop a plan for the long term maintenance and operation of the facility including entities responsible, financial obligations for continued O&M, designated access for maintenance, and schedule of O&M activities. The plan shall be developed in accordance with Appendix E, Inspection and Maintenance Agreement, and submitted to Columbia County for review and approval

#### **(5) Evidence of Acquisition of Applicable Local and Non-local Permits**

#### **(6) Waiver Requests**

The completed final stormwater site plan should be submitted to Columbia County for final approval prior to any construction activities on the development site.

### **1.5.2.8 Obtain Non-Local Permits**

The developer should obtain any applicable non-local environmental permits such as 404 wetland permits, 401 water quality certification, or construction NPDES permits prior to or in conjunction with final plan submittal. In some cases, a non-local permitting authority may impose conditions that require the original concept plan to be changed. Developers and engineers should be aware that permit acquisition can be a long, time-consuming process.

### 1.5.2.9 Final Stormwater Site Plan Approval

The drainage system and all stormwater management structures within Columbia County (including both public and private portions) will be designed to the same engineering and technical criteria and standards. The Columbia County Engineering Department's review will be the same whether the portion of the drainage system will be under public or private control or ownership.

The Stormwater Management Plan shall not be considered approved without the inclusion of an approval stamp with a signature and date on the plans by the Columbia County Building, Commercial, and Engineering Services Division. The stamp of approval on the plans is solely an acknowledgment of satisfactory compliance with the requirements of this manual. The approval stamp does not constitute a representation or warranty to the applicant or any other person concerning the safety, appropriateness or effectiveness of any provision, or omission from the plan.

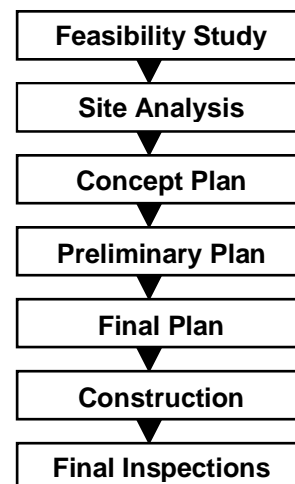
The person responsible for the land disturbing activity shall provide an "as-built" plan certified by a registered professional engineer to be submitted upon completion of the stormwater management facilities included in the stormwater management plan. Two printed mylars and one electronic copy, compatible with the software system (Autocad/ARC Info) in use by Columbia County at the time of submittal, of the "as-built" plan shall be submitted to Columbia County Building, Commercial, and Engineering Services Division. The registered professional engineer shall certify that the facilities have been constructed as shown on the "as-built" plan, and the facilities meet the approved stormwater management plan and specifications or achieves the function for which they were designed.

## 1.5.3 Stormwater Planning in the Development Process

### 1.5.3.1 General Site Development Process

Figure 1.5.3-1 depicts a typical site development process from the perspective of the land developer. After an initial site visit the developer assesses the feasibility of the project. If the project is deemed workable, a survey is completed. The design team prepares a concept plan (often called a sketch plan) for consultation with Columbia County Building, Commercial, and Engineering Services Division. A preliminary plan is then prepared and submitted for necessary reviews and approvals. Federal, state and local permits are applied for at various stages in the process.

After review by Columbia County and possible public hearings, necessary revisions are made and a final construction plan is prepared. There may be several iterations between plan submittal and plan approval. Bonds are set and placed, contractors are hired, and construction of the project takes place. During and after construction numerous types of inspections take place. At the end of construction, there is a final inspection and a use and occupancy permit is issued for the structure itself.



**Figure 1.5.3-1 Typical Site Development Flowchart**

### 1.5.3.2 Stormwater Site Planning and Design

Stormwater site planning and design is a subset of overall site development and must fit into the overall process if it is to be successful. Table 1.5.3-1 on the next several pages shows how planning for the stormwater management system fits into the site development process from the perspective of the developer and site planner/engineer. For each step in the development process, the stormwater-related objectives are described, along with the key actions and major activities that are typically performed to meet those objectives.



**Table 1.5.3-1 Stormwater Planning in the Site Development Process**

### **Feasibility Study**

#### **Description:**

A feasibility study is performed to determine the factors that may influence the decision to proceed with the site development, including the basic site characteristics, Columbia County and other governmental requirements, area information, surrounding developments, etc.

#### **Stormwater-Related Objectives:**

- Understand major site constraints and opportunities
- Understand Columbia County and other requirements

#### **Key Actions**

- Initiate discussions with Columbia County
- Pre-consultation between developer and plan reviewer
- Determine Columbia County stormwater management requirements

#### **Major Activities**

- Base map development
- Review of project requirements
- Review of Columbia County development and stormwater management requirements
- Review of Columbia County stormwater master plans or comprehensive plans
- Joint site visit with Columbia County
- Collection of secondary source information
- Determination of other factors or constraints impacting feasibility

### **Site Analysis**

#### **Description:**

A site analysis is used to gain an understanding of the constraints and opportunities associated with the site through identification, mapping and assessment of natural features and resources. Potential conservation and resource protection areas are identified at this stage.

#### **Stormwater-Related Objectives:**

- Identify key site physical, environmental, and other significant resources
- Develop preliminary vision for stormwater management system

#### **Key Actions**

- Site evaluation and delineation of natural feature protection areas

#### **Major Activities**

- Mapping of natural resources: soils, vegetation, streams, topography, slope, wetlands, floodplains, aquifers
- Identification of other key cultural, historic, archaeological, or scenic features, orientation and exposure
- Identification of adjacent land uses
- Identification of adjacent transportation and utility access
- Identification of natural feature protection and conservation areas
- Mapping of easements and utilities
- Integration of all layers -- map overlay
- Other constraints and opportunities

**Table 1.5.3-1 continued**

### **Concept Plan**

#### **Description:**

A concept plan is used to provide both the developer and reviewer a preliminary look at the development and stormwater management concept. Based on the site analysis, a concept plan should take into account the constraints and resources available on the site. Several alternative "what if" concept plans can be created.

#### **Stormwater-Related Objectives:**

- Develop concept for stormwater management system
- Gain approval from developer and Columbia County of concept plan

#### **Key Actions**

- Develop site layout concept using better site design techniques where possible
- Perform initial runoff characterization based on site layout concept
- Determine necessary site design and/or structural controls needed to meet stormwater management requirements.

#### **Major Activities**

- Prepare sketches of functional land
- "What If" analysis of different design concepts
- Unified stormwater sizing criteria preliminary calculations
- Utilization of better site design concepts and crediting mechanisms in layout concept
- Preliminary selection and siting of structural stormwater controls
- Location of drainage / conveyance facilities

### **Preliminary and Final Plan**

#### **Description:**

A preliminary site plan is created for Columbia County's review, which includes roadways, building and parking locations, conservation areas, utilities and stormwater management facilities. Following Columbia County's approval, a final set of construction plans are developed.

#### **Stormwater-Related Objectives:**

- Prepare preliminary and final stormwater management site plan
- Secure appropriate permits

#### **Key Actions**

- Perform runoff characterization based on preliminary / final site plan
- Design structural stormwater controls and conveyance systems
- Perform downstream analysis

#### **Major Activities**

- Preliminary / Final site layout plan
- Unified stormwater sizing criteria calculations
- Calculation of site design credit
- Selection, siting and design of structural stormwater controls
- Design of drainage and conveyance facilities
- Development of erosion and sedimentation control plan and landscaping plan
- Applications for needed permits and waivers

**Table 1.5.3-1** continued

### ***Construction***

#### **Description:**

During the construction stage, the site must be inspected regularly to ensure that all elements are being built according to plan, and that all resource or conservation areas are suitably protected during construction.

#### **Stormwater Objectives:**

- Ensure that stormwater management facilities and site design practices are built as designed

#### **Key Actions**

- Pre-construction meeting
- Inspection during construction

#### **Major Activities**

- Execution of bonds
- Inspection during key phases or key installations
- Protection of structural stormwater controls
- Protection of conservation areas
- Erosion and sedimentation control
- Proper sequencing

### ***Final Inspection***

#### **Description:**

After construction, the site must be inspected to ensure that all elements are completed according to plan. Long-term maintenance agreements should be executed.

#### **Stormwater Objectives:**

- Ensure that stormwater management facilities and site design practices are built and operating as designed

#### **Key Actions**

- Final Inspection and submission of record drawings
- Maintenance inspections

#### **Major Activities**

- Final stabilization
- As-built survey
- Execution of maintenance agreements
- Final inspection and use permit

---

**This page left intentionally blank.**